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(54) Pipeline with ground anchors.

(57) Pipeline to be used at the seabed, for the transport of gas or oil, provided with protrusions at its outer surface, at a distance from each other and serving as ground anchors. The protrusions extend around at least part of the circumference of the pipe. In a preferred embodiment of the protrusion, it has a gutter-shape. In case of pipelines, covered with concrete the ground anchors are dike-profiles in the concrete.

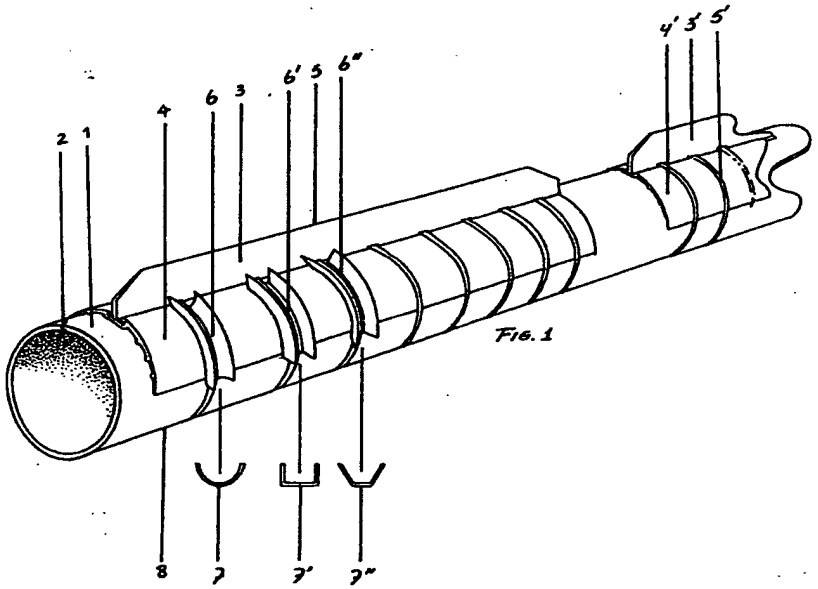

Fig. 1

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The invention relates to pipelines, for use on the bottom of the sea to transport gas or oil, provided with elongated protrusions on their outer surfaces.

Such pipes are for instance used to transport gas and/or oil on the continental shelf. For safety reasons, such pipes should be dug into the bottom of the sea and should stay dug in there. A digging depth minimally prescribed by the authorities for such pipes is 20 centimetres plus the pipe diameter.

It is known to provide such pipes at their outer walls with protruding parts that make a pipe dig itself into the bottom of the sea under the influence of the sea current.

With such pipelines, the difficulty often occurs, that as a consequence of the relatively high temperatures of the medium to be transported, the pipe starts 'working'. The pipe will expand because of the heat, which may lead to its 'bulging'; it will show the so-called 'upheaval-buckling'. This 'bulging' occurs uncontrolledly and sometimes even leads to a kink in the pipe. The chance that said 'upheaval buckling' occurs, should be as small as possible, and should preferably be reduced to nil.

Various possibilities to solve the problem have been proposed and tested. For instance, the use of a rough outer surface of a pipe, such as sand applied to the surface by means of glue. The grip of the pipe on the subsoil will then be improved, and the chance of 'working' will hence become smaller. The result, however, was insufficient.

Another solution has been looked for in laying the pipeline in a sine shape, flat on the seabed. Because of the sine shape, the occurring expansion forces would find their way out sideways instead of in an upward way. This, however, did not either lead to the desired result: the pipe 'jumped' here and there again upwards. A further disadvantage was that when a flow occurs through the pipe, this will show a tendency to swing.

The invention now provides a solution for said problems and a pipeline according to the invention thereto shows the characteristic that the protrusions extend around at least part of the circumference of the pipe, having a large component qua longitudinal direction, squarely on the axis of the pipe and seen in the longitudinal direction of the pipe, lying at a distance from each other.

It has surprisingly turned out that an anchorage of the pipe obviously takes care by means of such cross pipe protrusions that tensions occurring in the external wall as a consequence of heating, equally divided over the length of that wall, therein occur. Through this steadiness of the division, it is prevented that said upheaval buckling occurs. In many cases, said ground anchors will not be around the whole circumference of the pipe, this in order to make the unwinding of the pipe possible in an easy way. Across part of the surface, for instance over an angle of 60°, this will then be smooth.

Naturally, demands will be put to the protrusions, if they have to meet the objective intended. Those demands depend on the situation occurring in a concrete case. In particular, in case of use with a certain large difference of temperature, it applies to the height of such a ground anchor and to the mutual distance, seen in the longitudinal direction of the pipe, that these should be tuned to the dimensions of the pipe and the composition of the ground. It thus appeared that for a pipeline with a wall-thickness of 1.4 centimetres and a diameter of 30 centimetres, through which gas of a temperature of 80 C° was transported and that was dug into a substratum of sand with an average grain size of 175 μ, a height of the ground anchor of 4 centimetres in combinations with a mutual distance of 30 centimetres, was very satisfactory.

The ground anchors may be realized in various ways. In a preferred embodiment according to the invention, the ground anchors are mainly annular and comprise at least part of the circumference.

Although there are various possibilities to realize the protrusions, it is preferred to realize the ground anchors as trough-shaped constructions with upright walls. These will then lie with their bottoms against the outer surface of the pipe, either as separate rings, or as spirals.

In case of pipelines that are covered with concrete, ground anchors according to the invention may be realized by fitting into the concrete a so called dike profile, at which the 'dikes' then form said protrusions.

Pipelines are in particular satisfactory when they are provided with ground anchors according to the invention, in combination with a fin running in the longitudinal direction of the pipe: a spoiler. The natural digging in of the pipe obtained with the help of the spoiler makes that the anchorage of the pipe, as intended with the invention, will be easier and better realized.

A further advantage of last-mentioned combination is, that a spoiler is usually kept in its place by means of strips around the pipe. In an embodiment of the pipeline according to the invention, strips, used to keep the spoiler at its place, may simultaneously be used to fix the ground anchors against the pipe. One should in particular think hereby of the use of ground anchors in the form of annular troughs.

The invention will be further explained by means of the drawing, in which:

Fig.1 shows in perspective a pipeline according to the invention with trough-

shaped ground anchors and provided with a spoiler, and

Fig.2 shows such a pipeline with a concrete covering with a dike profile.

In Fig.1, 1 is a pipeline with a wall-thickness 2. On this pipe 1, spoilers 3 and 3' respectively are mounted. Mounting has been realized by means of seats 4 and 4' respectively that grab across part of the outer surface of pipe 1. Spoiler and seat are kept in place by means of strips 5 and 5' respectively.

With 6, 6' and 6" the ground anchors are indicated. In the drawn example as ring parts, grabbing around the outer surface of pipe 1 - the bottom of the pipe is not encircled by the ground anchors, so that they do not form any impediment in case of the uncoiling of the pipe. In general, however, the ground anchors will grab across the pipe over more than 180° in order to guarantee a more secure fastening.

The ground anchors drawn are all trough-shaped; see therefor the trough sections 7, 7' and 7": 7 (6) is a round trough; 7' (6") is a trough with a rectangular section and 7" (6) is a trough with obliquely standing walls.

In the example drawn in Fig. 1, the strips 5, with which the spoiler 3 is kept in its place, are also fastening the trough-shaped ground anchors 6 around the surface of pipe 1.

In Fig.2, 1 again indicates a pipeline. In the drawn example this has been surrounded by a casing 9 of for instance concrete. The concrete casing 9 shows a so-called dike profile, which means that it is provided with annular indentations 10. Thus, again a profile has been obtained of the outer surface of pipe 1, that shows protrusions/ ground anchors and that with respect to the equal dividing across the length of the pipe of tensions as a consequence of expansion through heat, will yield the desired result.

Claims

1. Pipeline, to be used at the seabed for the transport of gas or oil, provided with elongated protrusions at its outer surface. characterized in that those protrusions work as ground anchors and extend thereto around at least part of the circumference of the pipe, having a large component qua longitudinal direction, squarely on the axis of the pipe and seen in the longitudinal direction of the pipe, lying at a distance from each other.

2. Pipeline according to claim 1, characterized in that - in case of a certain large difference in temperature occurring - the height of a ground anchor to be chosen and the - seen in the longitudinal direction of the pipe - distance to be chosen between the ground anchors, depends on the dimensions of the pipe and on the composition of the ground.

3. Pipeline according to claim 2, characterized in that for a steel pipe with a wall-thickness of 1.4 centimetre and a diameter of 30 centimetres, to be used on sand with an average grain size of 175 μ, the height of the ground anchors is 4 centimetres and the mutual distance in the longitudinal direction of the pipe amounts to 30 centimetres.

4. Pipeline according to one of the claims 1 - 3, characterized in that the ground anchors are mainly annular and that they encircle the pipe across at least part of the circumference.

5. Pipeline according to one of the preceding claims, characterized in that the ground anchors are made up by the upright walls of trough-shaped constructions that are fixed with their bottoms on the surface of the pipe.

6. Pipeline according to one of the claims 1 - 5, covered with concrete, characterized in that the ground anchors are made up by a so called dike profile in the concrete.

7. Pipeline, at its surface provided with longitudinal fins - so-called spoilers -, characterized in that it is provided with ground anchors according to one of the preceding claims.

8. Pipeline according to claims 5 and 7, the spoiler being fixed thereto by means of strips around the pipe, characterized in that the trough construction is kept fixed against the wall of the pipe by said strips, which run through the trough.

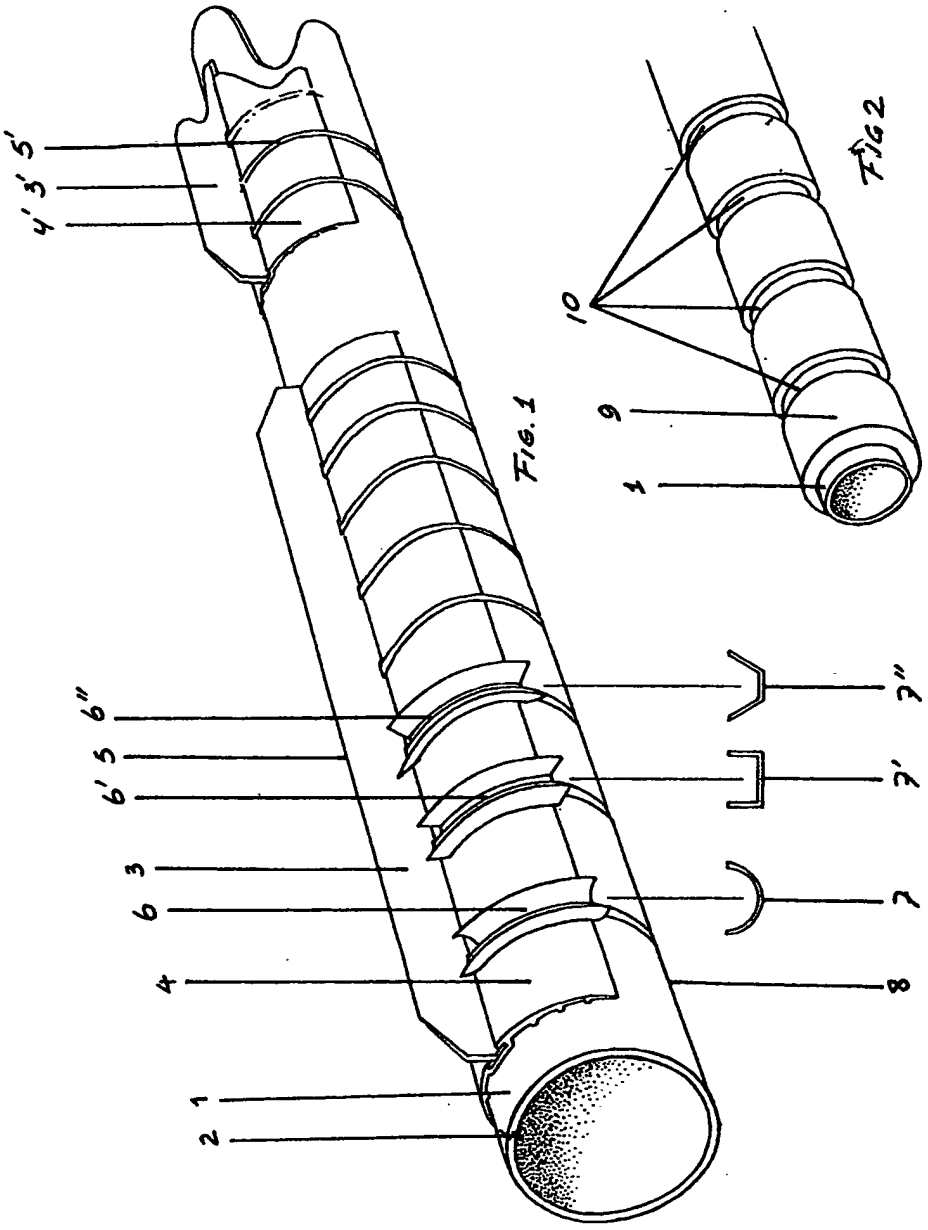

Fig. 1

Fig 2

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EUROPEAN SEARCH REPORT

Application Number

EP 91 20 1407

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	GB-A-2 137 721 (STICHTING WATERBOUWKUNDIG LABORATORIUM) * Abstract; fig. *	1	F 16 L 1/16 F 16 L 1/12
A	EP-A-0 020 232 (COYNE ET BELLIER)		

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

F 16 L

The present search report has been drawn up for all claims

Place of search	Date of completion of search	Examiner
The Hague	21 October 91	BARTSCH A.W.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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